FORM PTO-1390 (REV 5-93) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: **225/50985**

U S APPLICATION NO (if known, see 37 CFR 1.5): **10/088211**

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP00/08735	**07 September 2000 (07.09.00)**	**15 September 1999 (15.09.99)**

TITLE OF INVENTION: **VEHICLE DATA BUS SYSTEM HAVING LOCATING MEANS**

APPLICANT(S) FOR DO/EO/US: **Stefan HOFFMAN; Peter HOYLAND; Reiner KNAPP; Michael MAEHNER and Matthias SCHLUTTER**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1.	X	This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2.		This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371
3.		This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay Examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4.	X	A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5.	X	A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
		a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).
		b. [X] has been transmitted by the International Bureau **(FORM PCT/IB/308 attached)**
		c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US)
6.	X	A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7.		Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
		a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
		b. [ ] have been transmitted by the International Bureau.
		c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
		d. [ ] have not been made and will not be made.
8.		A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9.	X	An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) **(Unexecuted - 2 page)**
10.	X	A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Item 11. to 16. below concern other document(s) or information included:

11.	X	An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12.		An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13.	X	A FIRST preliminary amendment.
		A SECOND or SUBSEQUENT preliminary amendment.
14.	X	A substitute specification and marked-up copy thereof.
15.		A change of power of attorney and/or address letter.
16.	X	Other items or information:

a. Form PCT/IB/308
b. Four (4) sheets of drawings showing Figures 1, 2, 3, 4
c. First page of published International Application (WO 01/20575 A1)
d. Application Data Sheet (2 pages)

U.S. APPLICATION NO (if known, see 37 CFR 1 5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
10/088211	PCT/EP00/08735	225/50985

17. [X] The following fees are submitted:		CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO	$ 890.00	$ 890.00	
International preliminary examination fee paid to USPTO (37 CFR 1.482)	$ 690.00		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)	$ 740.00		
Neither international preliminary examination fee (37 CFR 1.482) nor International search fee (37CFR 1.445(a)(2) paid to USPTO	$ 1000.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	$ 100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =		$ 890.00	
Surcharge of $130.00 for furnishing the oath or declaration later than [ ] 20 [X] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		$ 130.00	

Claims	Number Filed	Number Extra	Rate		
Total Claims	10 - 20 =	0	X $18.00	$	
Independent Claims	1 - 3 =	0	X $84.00	$	
Multiple dependent claims(s) (if applicable)			+ $280.00	$	

TOTAL OF ABOVE CALCULATIONS=	$130.00	
Applicant claims Small Entity Status (See 37 CFR §1.27) [ ] yes [ ] no. Reduction by 1/2 for filing by small entity, if applicable.	$	
SUBTOTAL =	$1,020.00	
Processing fee of $130.00 for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)).	$	
TOTAL NATIONAL FEE =	$1,020.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28,3.31). $40.00 per property +	$	
TOTAL FEE ENCLOSED =	$1,020.00	
	Amount to be: refunded	$
	Charged	$

a. [X] Two checks in the amount of $ 1,020.00 for the filing fee is enclosed

b. [ ] Please charge my Deposit Account No. 05-1323 in the amount of $____ to

c. [X] The Commissioner is hereby authorized to charge any additional fees, which may be required, or credit any overpayment to Deposit Account No. 05-1323 . **(Attorney Docket No. 225/50985.)** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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APPLICATION DATA SHEET

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CORRESPONDENCE INFORMATION

Correspondence customer number:: 23911

APPLICATION INFORMATION

Title line one::	VEHICLE DATA BUS SYSTEM WITH
Title line two::	POSITIONING MEANS
Total drawing sheets::	Four (4)
Formal drawings?::	YES
Application type::	Utility
Docket Number::	225/50985

REPRESENTATIVE INFORMATION

Representative customer number:: 23911

PRIOR FOREIGN APPLICATIONS

Foreign application one::	PCT/EP00/08735
Filing date::	07 September 2000 (07.09.00)
Country::	PCT
Priority claimed::	YES
Foreign application two::	199 44 177.4
Filing date::	15 September 1999 (15.09.99)
Country::	GERMANY
Priority claimed::	YES

Attorney Docket: 225/50985
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: STEFAN HOFFMANN ET AL

Serial No.: NOT YET ASSIGNED PCT No. PCT/EP00/08735

Filed: MARCH 15, 2002

Title: VEHICLE DATA BUS SYSTEM WITH POSITIONING MEANS

PRELIMINARY AMENDMENT

Box PCT **March 15, 2002**
Commissioner for Patents
Washington, D.C. 20231

Sir:

Please enter the following amendments to the specification and claims, as amended by way of Annexes to the International Preliminary Examination Report for PCT/EP00/08735, prior to the examination of the application during the U.S. National Phase.

IN THE SPECIFICATION:

Submitted herewith is a substitute specification and marked-up copy thereof which includes the changes made by way of the Annexes to the International Preliminary Examination Report.

IN THE CLAIMS:

Please amend the claims as follows: **(A copy of a marked up version with markings to show changes made is attached hereto.)**

1. (Amended) A vehicle data bus system comprising:

a data bus which connects a plurality of bus users in data communication with one another; and

locating apparatus, including a locating module connected as one of the bus users and configured to receive wheel speed data and to acquire vehicle position data, direction of travel angle data and travel speed data and to output this acquired data onto the data bus; wherein,

the locating module has a locating computing unit and a locating sensor system which comprises at least a GPS receiver with associated GPS antenna and gyro data-determining means;

the locating module is configured to receive wheel speed data via the data bus;

the locating module is further configured to receive forward/backward direction of travel data via the data bus, and to acquire

altitude position data and to output acquired altitude position data onto the data bus; and

the gyro data-determining means comprises one of gyro data-sensing means in the form of a gyroscope, and means for the bus-end reception and evaluation of gyro data of a travel dynamics/traction control system.

2. (Amended) The vehicle data bus system according to Claim 1, further comprising means for providing location precision classification information which indicates a degree of unreliability of calculated position data.

3. (Amended) The vehicle data bus system according to Claim 2, wherein the locating precision classification is output onto the data bus.

4. (Amended) The vehicle data bus system according to Claim 1, wherein the locating module contains an integrated GPS antenna.

5. (Amended) The vehicle data bus system according to Claim 1, further comprising an additional bus user in the form of a navigation unit, which receives vehicle position data from the locating module via the data bus, and by means of a map-matching process acquires position correction data which it inputs into the data bus in order to feed it back to the locating module.

6. (Amended) The vehicle data bus system according to Claim 5, wherein the navigation unit determines a corrected, precise vehicle position with a new locating precision classification and outputs it onto the data bus.

7. (Amended) The vehicle data bus system according to Claim 5, wherein the navigation unit determines accompanying travel network information and outputs it onto the data bus.

8. (Amended) The vehicle data bus system according to Claim 1, wherein at least one telematics service unit is provided as a further bus user which uses data acquired from the locating module or the navigation unit.

9. (Amended) The vehicle data bus system according to Claim 1, further comprising an additional bus user in the form of an engine and/or gearbox control unit, uses altitude position data acquired from the locating module.

10. (Amended) The vehicle data bus system according to Claim 1, wherein:

the locating module is part of a further bus user; and

the locating computing unit is used by the further bus user, for additional tasks.

IN THE ABSTRACT:

Please substitute the new Abstract of the Disclosure submitted herewith on a separate page for the original Abstract presently in the application.

(Applicant's Remarks are set forth hereinbelow, starting on the following page.)

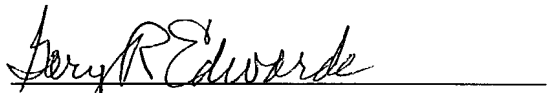
REMARKS

Entry of the amendments to the specification and claims, as amended by way of Annexes to the International Preliminary Examination Report for PCT/EP00/08735, before examination of the application in the U.S. National Phase is respectfully requested.

If there are any questions regarding this Preliminary Amendment or this application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #225/50985).

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE CLAIMS

Please amend the claims as follows:

1. (Amended) A vehicle [Vehicle] data bus system [having the following features:] comprising:

[-] a data bus [(1) via] which connects a plurality of [connected] bus users in data communication with [have a data transmission connection to] one another; [,] and

[-] locating apparatus, including [means with] a locating module [(2) which is embodied] connected as one of the bus users and [which is] configured to receive wheel speed data and to acquire vehicle position data, direction of travel angle data and travel speed data and to output this acquired data onto the data bus; [, and for this purpose] wherein,

the locating module has a locating computing unit [(2a)] and a locating sensor system which comprises at least a GPS receiver [(2b)] with associated GPS antenna [(4)] and gyro data-determining means; [, characterized in that]

the locating module [(2)] is configured to receive [the] wheel speed data via the data bus; [(1),]

the locating module [(2) being additionally] is further configured to receive forward/backward direction of travel data via the data bus, [(1),] and to acquire altitude position data and to output [this] acquired altitude position data onto the data bus; [(1),] and

[it being possible for] the gyro data-determining means comprises one of [to be] gyro data-sensing means [(2c)] in the form of a gyroscope [(2c)], and [or] means for the bus-end reception and evaluation of gyro data of a travel dynamics/traction control system.

2. (Amended) The vehicle [Vehicle] data bus system according to Claim 1, further comprising means for providing [characterized in that the] location precision classification information which indicates [the] a degree of unreliability of [the] calculated position data. [is specified for the position data.]

3. (Amended) The vehicle [Vehicle] data bus system according to Claim 2, [further characterized in that] wherein the locating precision classification is output onto the data bus. [(1).]

4. (Amended) The vehicle [Vehicle] data bus system according to Claim 1, wherein [2 or 3, further characterized in that] the locating module [(2")] contains an integrated GPS antenna. [(4a).]

5. (Amended) The vehicle [Vehicle] data bus system according to [one of Claims 1 to 4,] Claim 1, further comprising an additional [characterized in that a further] bus user [is formed by] in the form of a navigation unit, [(5),] which receives [the] vehicle position data from the locating module [(2)] via the data bus, [(1),] and by means of a map-matching process acquires position correction data which it inputs into the data bus in order to feed it back to the locating module.

6. (Amended) The vehicle [Vehicle] data bus system according to Claim 5, [further characterized in that] wherein the navigation unit [(5)] determines a corrected, precise vehicle position with a new locating precision classification and outputs it onto the data bus. [(1).]

7. (Amended) The vehicle [Vehicle] data bus system according to Claim 5, wherein [or 6, further characterized in that] the navigation unit [(5)] determines accompanying travel network information and outputs it onto the data bus. [(1).]

8. (Amended) The vehicle [Vehicle] data bus system according to [one of Claims 1 to 7, further characterized in that one or more] Claim 1, wherein at least one telematics service [units (3) are] unit is provided as a further bus [users] user which uses [use] data acquired from the locating module [(2)] or the navigation unit. [(5).]

9. (Amended) The vehicle [Vehicle] data bus system according to [one of Claims 1 to 8, further characterized in that] Claim 1, further comprising an additional bus user in the form of an engine and/or gearbox control unit, [which makes use of the] uses altitude position data acquired from the locating module. [(2), is provided as a respective further bus user.]

10. (Amended) The vehicle [Vehicle] data bus system according to [one of Claims 1 to 9, further characterized in that] Claim 1, wherein:

the locating module [(2)] is part of a further bus user; and [,]

the locating computing unit [(2a) being] is used by the further [this] bus user, for additional tasks.

ABSTRACT OF THE DISCLOSURE

A vehicle data bus system includes locating means which comprise a locating computing unit and a locating sensor system which contains at least one GPS receiver with associated GPS antenna and gyro data acquisition means, and a data bus via which connects a plurality of bus users in data communication with one another. The locating means contain a locating module which is embodied as one of the bus users and is configured to receive at least wheel speed data and forward/backward direction of travel data via the data bus, to acquire at least vehicle position data, direction of travel angle data, travel speed data and altitude position data as well as to output this acquired data onto the data bus. For this purpose, the locating module contains the location computing unit, the GPS receiver and a gyroscope or means for the bus-end reception and evaluation of gyro data of a travel dynamics/traction control system.

Attorney Docket: 225/50985
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: STEFAN HOFFMANN ET AL

Serial No.: NOT YET ASSIGNED PCT No. PCT/EP00/08735

Filed: MARCH 15, 2002

Title: VEHICLE DATA BUS SYSTEM WITH POSITIONING MEANS

SUBMISSION OF SUBSTITUTE SPECIFICATION

Commissioner for Patents
Washington, D.C. 20231

March 15, 2002

Sir:

Attached is a Substitute Specification and a marked-up copy of the original specification. I certify that said substitute specification contains no new matter and includes the changes indicated in the marked-up copy of the original specification.

Respectfully submitted,

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4/prts

Clean version of Substitute Specification
Attorney Docket No. 225/50985

VEHICLE DATA BUS SYSTEM HAVING LOCATING MEANS

BACKGROUND AND SUMMARY OF THE INVENTION

[0001] This application claims the priority of PCT International Application No. PCT/EP00/08735, filed 07 September 2000 and German patent document 199 44 177.4, 15 September 1999, the disclosure of which is expressly incorporated by reference herein.

[0002] The invention relates to a vehicle data bus system having a location determining arrangement that includes a locating computing unit and a locating sensor system having at least one GPS (Global Positioning System) receiver with associated GPS antenna and gyro data acquisition means, the data bus system also having a plurality of bus users connected to a data bus, for data transmission to one another.

[0003] European patent document EP 789 343 A1 discloses a vehicle data bus system of the generic type, having locating means and a plurality of connected bus users. GPS receivers, gyro data sensors, wheel speed sensors, tachometers, odometers and acceleration sensors can be used as locating sensor systems. A locating computing unit uses the data of the locating sensor

system to determine the position data which can be output onto the data bus.

[0004] Motor vehicles of advanced design frequently include position determining devices that operate on the basis of the GPS, and when necessary, the latter are supported by further position-determining devices for compound navigation (for example, a gyroscope and an odometer). In addition, a plurality of vehicle-mounted components, (conventionally control devices referred to herein as "bus users", for performing local vehicle-mounted control functions), are frequently connected to one another via a data bus which can be part of an entire data bus network.

[0005] Recently, telematics service units are also becoming significant bus users. Such telematics service units have a communications connection, on the one hand, to the "vehicle world" via the vehicle data bus and, on the other hand, to remote stations, which are external to the vehicle, via one or more wireless transmission channels. They may be used for example, to perform functions such as emergency calls, pursuit of thieves, determination of traffic situation data of sample vehicles etc.

[0006] In earlier motor vehicles of this type, the locating devices on the one hand and the data bus with connected vehicle

control devices on the other hand formed separate vehicle subsystems, and frequently only one of the two was implemented. The locating devices themselves were frequently composed of a relatively large number of individual components. U.S. Patent No. 5,644,317 for example, discloses an automatic vehicle locating system having a locating sensor system composed of a plurality of individual sensor units, and a locating computing unit which receives output signals of the various locating sensor units. The locating computing unit outputs data relating to the vehicle position and vehicle situation to an external unit via a wireless communications channel for presentation of the transmitted position/situation data.

[0007] A vehicle-position-determining system disclosed in U.S. Patent No. 5,740,049 determines a first temporary position information item by reference to the output signals of a vehicle speed sensor and a gyroscope, and corrects it by deriving a second temporary position information item by reconciliation with stored route data. A third temporary position information item is acquired from the output signal of a GPS receiver. By evaluating or reconciling the various temporary position information items, a definitive vehicle position is determined and displayed on a screen in a road map view.

[0008] The locating devices are often an integrated component connected upstream of a vehicle navigation unit, for the sole purpose of supplying position and situation data (i.e., orientation of the vehicle in space) data for navigation and/or for visually displaying determined position or situation of the vehicle. See, for example, European patent document EP 0 675 341 A1 and International patent document WO 98/36288 A1.

[0009] International patent document WO 98/10246 A1 discloses a device for recording geographic data which, depending on the configuration, can be determined as a portable device or for installation in a vehicle, for example, and has not only position-determining means but also video cameras for recording images. A computer unit receives the data output by the positioning-determining means and the video cameras and evaluates it to determine the direction of the image relative to the device, or the geographic data for an object sensed with the camera. The device can have a communications connection via a wireless communications channel to a remote station, for example a central processor unit there.

[0010] German patent document DE 196 40 735 A1 discloses a telematics device for a motor vehicle, which includes a car radio with an RDS module and a built-in locating system with GPS module, a radio telephone with GSM module, a memory and a

display. The RDS module, the GPS module and the GSM module are installed together with a voice unit and the car radio in a housing of the telematics device. The housing has antenna terminals for at least the car radio, the GSM module and the GPS module as well as interfaces for at least one CAN bus and/or one further data bus as well as for at least one loudspeaker and/or a microphone. By means of travel sensors (for example wheel sensors, a direction sensor and/or the GPS module), the position of the vehicle can also be connected and output on a digital map of the visual display. By communicating with a control center or a navigation system which is built into the telematics device or a navigation module which can be connected thereto via the CAN bus or the further data bus, it is possible to calculate a desired travel route which is then displayed on the visual display. Via the CAN bus and/or the further data bus, the telematics device can influence an engine control unit which forms a further bus user.

[0011] One object of the invention is to provide a vehicle data bus system of the type described above which is flexible and convenient to use, and can be satisfactorily standardized.

[0012] This and other objects and advantages are achieved by the vehicle data bus system according to the invention, in which a locating module is embodied in a specific way as one of the bus

users connected to the data bus. Components of the locating module which are used for locating the vehicle are integrated primarily into a single structural unit. The associated locating sensor system is at least partially integrated into the locating module and also connected to the data bus so that the locating module acquires at least part of the necessary locating sensor data internally, and also receives it via the data bus. Specifically, the locating module contains a locating computing unit, which performs the computational determination of a position, and a GPS receiver. In addition, it has a gyroscope or means for receiving corresponding gyro data via the data bus from a travel dynamics/traction control system if the latter comprises the respective gyro data acquisition sensor system (as, for example, in some conventional travel dynamics control systems).

[0013] As a result of the modular combination and the data bus connection of the locating apparatus, they can be standardized form for use in different vehicles (and in different countries) without extensive adaptation measures, and can provide appropriate locating information on the data bus in a flexible way according to need, from which data bus said information can be called by other vehicle-mounted bus users. The locating information which is thus made available comprises, in particular, vehicle position data, direction of travel angle data, travel speed data and altitude data (data on the

instantaneous altitude position of the vehicle above sea level) (NN). In a preferred embodiment of the invention, a locating precision classification (location quality) is also provided in the form of an identifier which indicates the degree of unreliability of the calculated position data.

[0014] In order to determine the locating information, the locating module uses not only the gyro data and the GPS data, but also wheel speed data and data indicating whether the vehicle is driving forward or backward at a given time, which it obtains from the data bus. The locating information can be used, in particular for vehicle control units which perform various vehicle-related functions, such as travel dynamics control, anti-lock brake control, traction control, engine control and gearbox control, by display instruments such as a combination instrument or by a specific comfort information display, and also by communication units which communicate with vehicle-mounted components via the data bus and with remote components, external to the vehicle, via a wireless communications channel.

[0015] In another embodiment of the vehicle data bus system according to the invention, the structural unit which represents the locating module also contains an integrated GPS antenna so that it is unnecessary to mount a separate GPS antenna on the vehicle or to connect it to the locating module.

[0016] In still another embodiment of the invention, a navigation unit, which receives the position data from the locating module, is provided as a further bus user. By means of a conventional map-matching process in which this position data is compared with stored travel network data, it acquires improved position information with a new location position classification (location quality). The navigation unit characteristically feeds back the corresponding position correction data via the data bus to the locating module which can use said data for precision-improving correction reconciliation.

[0017] In yet another embodiment of the invention, one or more telematics service units are provided as further bus users, which use the locating data acquired from the locating module (for example for an emergency call function) to pursue thieves and/or to determine traffic situations using sample vehicles (what is referred to as a floating car data method).

[0018] According to another embodiment of the invention, an engine and/or a gearbox control unit, provided as a further bus user, utilizes the data bus connection, inter alia, to read in the altitude position data made available by the locating module. As a result, it is possible to dispense with an altitude sensor which is conventionally present in modern units of this type.

[0019] Finally, according to another feature of the invention, the locating module is part of a further bus user, which uses the locating computing unit for additional tasks.

[0020] Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Figure 1 is a partial schematic representation of a vehicle data bus system with locating module with integrated gyroscope and external GPS antenna according to the invention;

[0022] Figure 2 shows a data bus system corresponding to Figure 1, with an additional navigation unit;

[0023] Figure 3 shows a data bus system corresponding to that of Figure 2, with a locating module which does not have a gyroscope and which receives gyro data from the bus; and

[0024] Figure 4 shows a data bus system corresponding to Figure 2, with GPS antenna integrated into the locating module.

DETAILED DESCRIPTION OF THE DRAWINGS

[0025] The vehicle data bus system which is illustrated in Figure 1 (showing only those components which are of specific interest here) contains a data bus 1 to which a plurality of bus users are connected. Only a locating module 2 and a telematics service block 3 are shown explicitly, with one or more telematics service units for corresponding functionalities (for example emergency calls, pursuit of thieves and the determination of traffic situations using sample vehicles) being combined by the telematic service block 3, for simplicity. The locating module 2 is provided as a component that can be built on in a uniform fashion; it contains a locating computing unit 2a, a GPS receiver 2b and a gyroscope 2c in an integrated form in this example.

[0026] An external GPS antenna 4 which is mounted at a suitable location on the vehicle is connected to the GPS receiver 2b. The locating module 2 is coupled into the data bus 1 via a corresponding bus interface, from which it reads in wheel speed data and forward/backward direction of travel data. The wheel speed data can be supplied, for example, in the form of

rotational speed sensor pulses per time unit by a travel dynamics/traction control system which also acquires this data for its own use, in a known manner. The travel dynamics/traction control system can be, for example, an anti-lock brake system (ABS) or a travel dynamics control system which is used by the applicant under the abbreviation ESP (electronic stability program). The forward/backward direction of travel data indicates whether the vehicle is travelling forward or backward at a given time, and can originate, for example, from reverse-gear detection means, which determine whether or not the reverse gear is engaged.

[0027] Data that are necessary for locating, which the locating module 2 does not acquire from the data bus 1, are supplied by the integrated locating sensor units, specifically GPS data of the GPS receiver 2b and gyro data of the gyroscope 2c. The locating computing unit 2a then carries out the actual computational locating process. (The term "locating" is used here in a broad sense, which includes both a determination of the position of the vehicle and its altitude, and orientation in space.) That is, the locating computing unit 2a determines vehicle position data with its locating precision classification (location quality), direction of travel angle data, travel speed data and altitude data (altitude of the vehicle above sea level (NN)) at a given time. The locating computing unit 2a also

contains time-determining means which provide highly precise time information corresponding to a radio clock, the time valid in respective countries being given throughout the world, for example according to the GMT or UTC standard, without the user having to perform complicated menu settings for this purpose. The direction of travel angle data contains not only actual angle information but also offset, drift and scaling factor information.

[0028] The locating computing unit 2a feeds determined, conditioned locating data onto the data bus 1 where it is made available to the other bus users, for example to the telematics service units 3 and/or vehicle control units (not shown), for example engine and/or gearbox control unit, which are connected to the data bus 1. A connected engine or gearbox control unit can accept, in particular, the altitude position information made available by the locating module 2 on the data bus 1 and in this way does not require its own altitude sensor. When the system is started, the altitude value when the vehicle was last switched off is expediently used until current altitude position data is available again.

[0029] As is apparent from the explanations above, the locating module 2 performs a locating process using a plurality of parallel input information items, specifically the internally

acquired GPS data, the internally acquired gyro data and the wheel speed data received via the data bus 1, which is also used by the locating module 2 to perform an odometer function.

[0030] The vehicle data bus system illustrated in Figure 2 (again, with only those components which are specifically of interest here corresponds essentially to that in Figure 1. (Corresponding reference symbols are used for functionally identical elements.) The system in Figure 2, however, contains a navigation unit 5 as a further bus user. The navigation unit 5 receives the various locating data items supplied by the locating module 2 via the data bus 1, and uses the received position data in a conventional map-matching process in which the vehicle position determined by the locating module 2 is reconciled with data in a digitally stored travel network map. In this manner, the navigation unit 5 determines a precise vehicle position, corrected if appropriate, with a new locating precision classification (locating quality) and outputs this and accompanying travel network information (such as names of localities and roads), onto the data bus 1. The bus users connected to the data bus 1 can then use for this purpose the precise vehicle position data made available by the navigation unit 5 if they require vehicle position data. This applies in particular also to the telematics service units 3.

[0031] The navigation unit 5 also outputs onto the data bus 1 position correction data which represents the possible deviation of the precise vehicle position determined by it from the vehicle position determined by the locating module 2. The locating module 2 can obtain this fed-back position correction data or these correction parameters from the data bus 1 and use them for corresponding correction of the location which it determines, in order to improve the precision of the position-determining process.

[0032] The vehicle data bus system in Figure 3 corresponds to that in Figure 2, with a modified locating module 2' containing only the locating computing unit 2a and the GPS receiver 2b, but no gyroscope. In this case, the locating module 2' contains means for the bus-end reception and evaluation of gyro data of a travel dynamics/traction control system, e.g. by an ESP controller. This leads to satisfactory results if the gyro sensor means of the travel dynamics/traction control system have an adequate level of precision or efficiency and reliability. The travel dynamics/traction control system makes available the determined gyro data on the data bus 1, from where it can be called by the locating module 2'.

[0033] The vehicle data bus system illustrated in Figure 4 corresponds to that in Figure 2, with a modified locating module

2", that also contains an integrated GPS antenna 4a. As a result, the need for a GPS antenna which is to be separately mounted on the vehicle and connected to the locating module is dispensed with.

[0034] As the above exemplary embodiments make clear, the present invention implements a vehicle data bus system in which a locating module which is implemented as a stand-alone structural unit (for example in the form of a separate box or plug-in module) is integrated into the bus system as a bus user and contains all the components which are used for determining locations and receives input information necessary for this purpose via the data bus. The locating module can be used as a small standard box throughout the world in a wide variety of vehicles without extensive adaptation measures. Even without an implemented navigation functionality or emergency call functionality, it is possible to use the location-related services, such as pursuit of thieves, the determination of traffic situations using sample vehicles etc. by means of the locating data supplied by the locating module.

[0035] The use of the locating data provided by the locating module makes the system independent of the manufacturers of communications devices which are used, such as telephone sets. The locating data of the locating module can be used to display

the compass direction and/or degrees of longitude and of latitude of the current vehicle position, which can be helpful for breakdown information, for example. Furthermore, a high-precision clock with the display of the current time in any country throughout the world can be implemented without complicated menu settings by the user. The time can be displayed, for example, in a combination instrument or in an auxiliary heating module, so that the need for a separate clock chip can be avoided.

[0036] The use of altitude information of the locating module by an engine and/or gearbox electronic system makes it possible to avoid the need for a separate altitude sensor. The locating information which is made available by the locating module in a standardized form and which relates to the position, locating precision classification (locating quality), direction of travel angle, direction of rotation, altitude position, inclination of the vehicle, etc. can be used by means of the data bus in a flexible way by the various systems which are based on locating information, for, for example, emergency calls, calling taxis, navigation, devices which warn of imminent bends, the determination of traffic situations using sample vehicles, travel dynamics control systems, anti-lock brake systems, traction controllers, gearboxes, engine electronic systems, combination instruments and supplementary information.

[0037] The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to include everything within the scope of the appended claims and equivalents thereof.

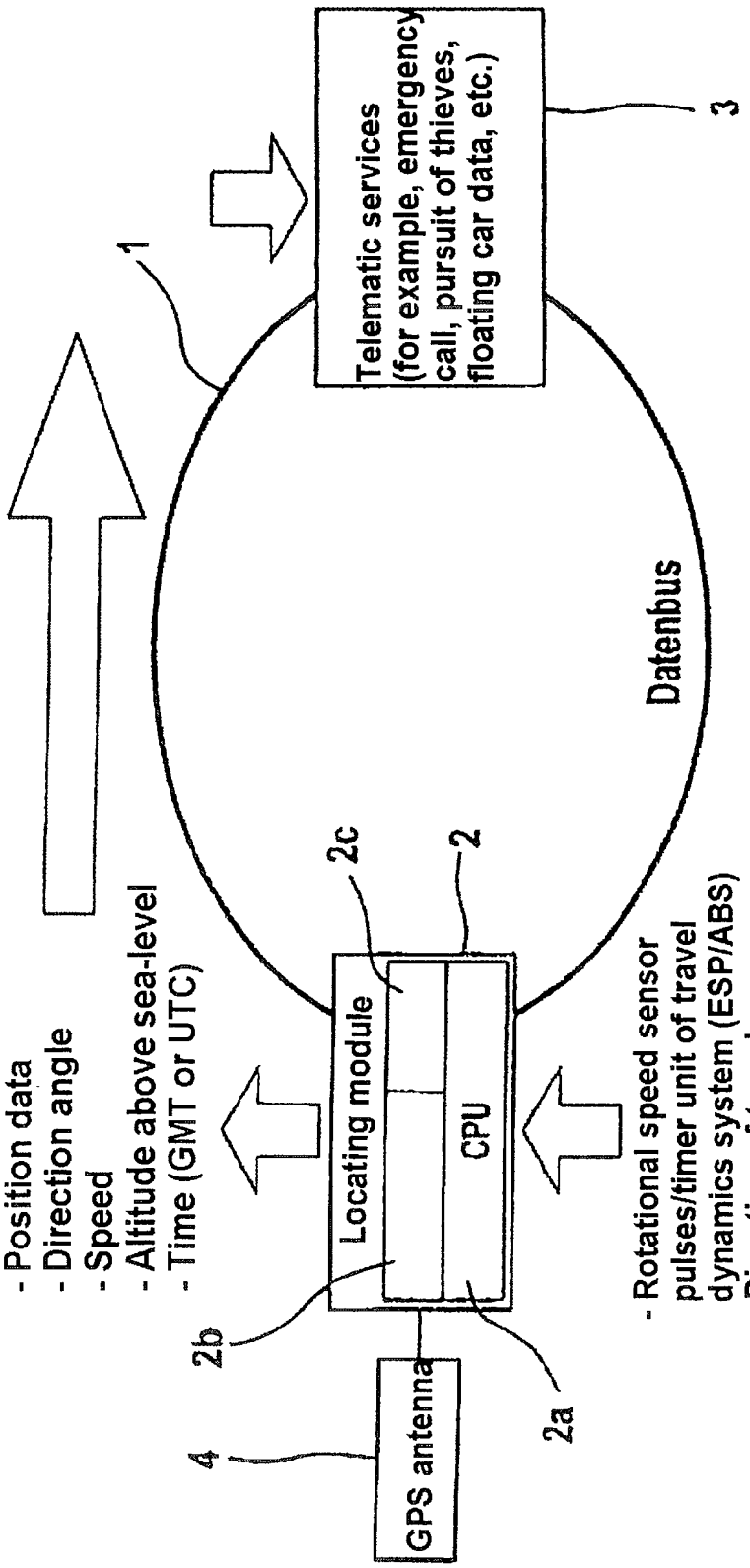
Telematic services
(for example, emergency call, pursuit of thieves, floating car data, etc.)
3
1
Datenbus
- Position data
- Direction angle
- Speed
- Altitude above sea-level
- Time (GMT or UTC)
2c
2
Locating module
CPU
2b
2a
- Rotational speed sensor pulses/timer unit of travel dynamics system (ESP/ABS)
- Direction of travel (forward/backward)
4
GPS antenna

Fig. 1

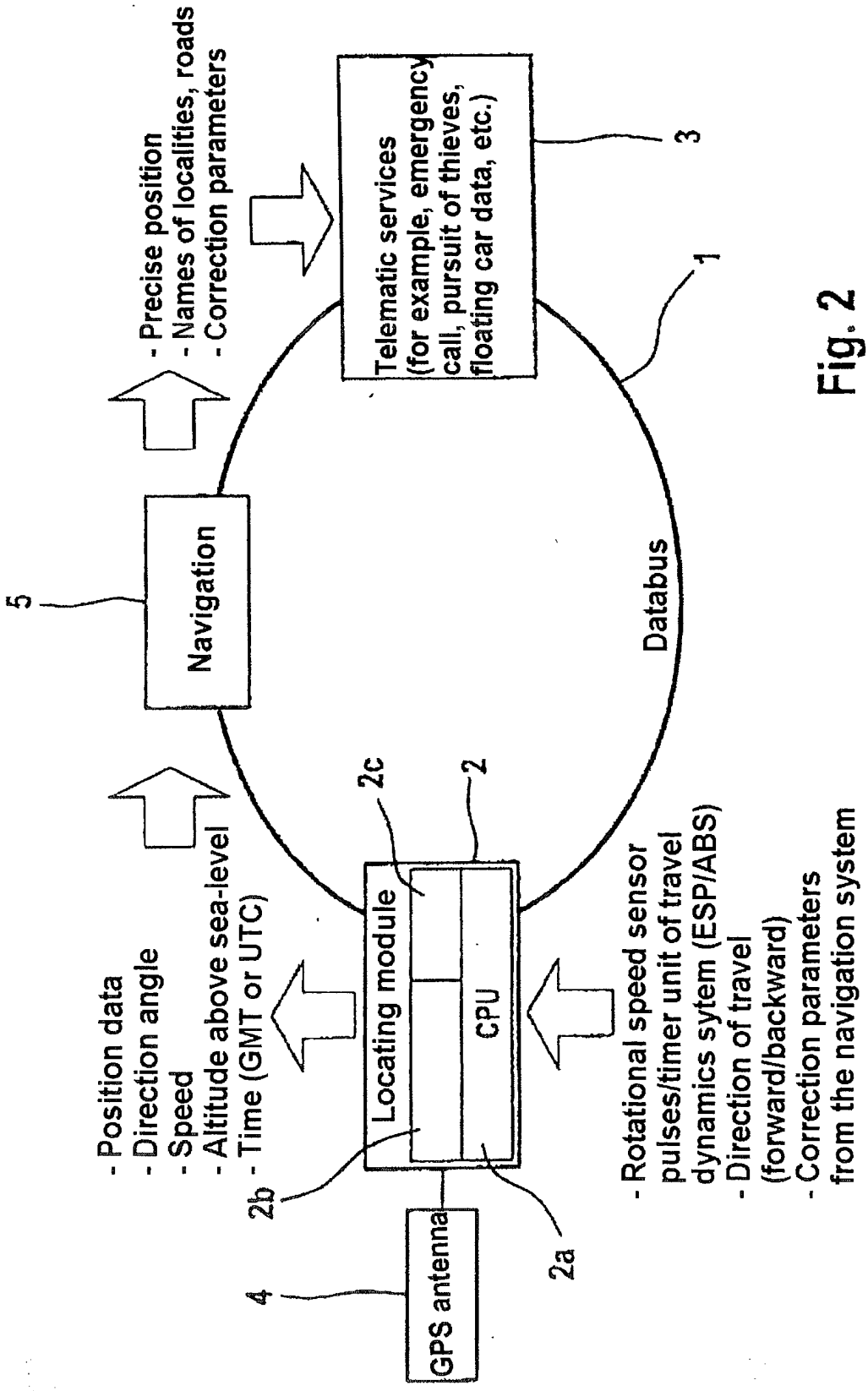
- Precise position
- Names of localities, roads
- Correction parameters
Telematic services
(for example, emergency call, pursuit of thieves, floating car data, etc.)
3
1
Databus
5
Navigation
- Position data
- Direction angle
- Speed
- Altitude above sea-level
- Time (GMT or UTC)
2c
2
Locating module
CPU
2b
2a
4
GPS antenna
- Rotational speed sensor pulses/timer unit of travel dynamics sytem (ESP/ABS)
- Direction of travel (forward/backward)
- Correction parameters from the navigation system

Fig. 2

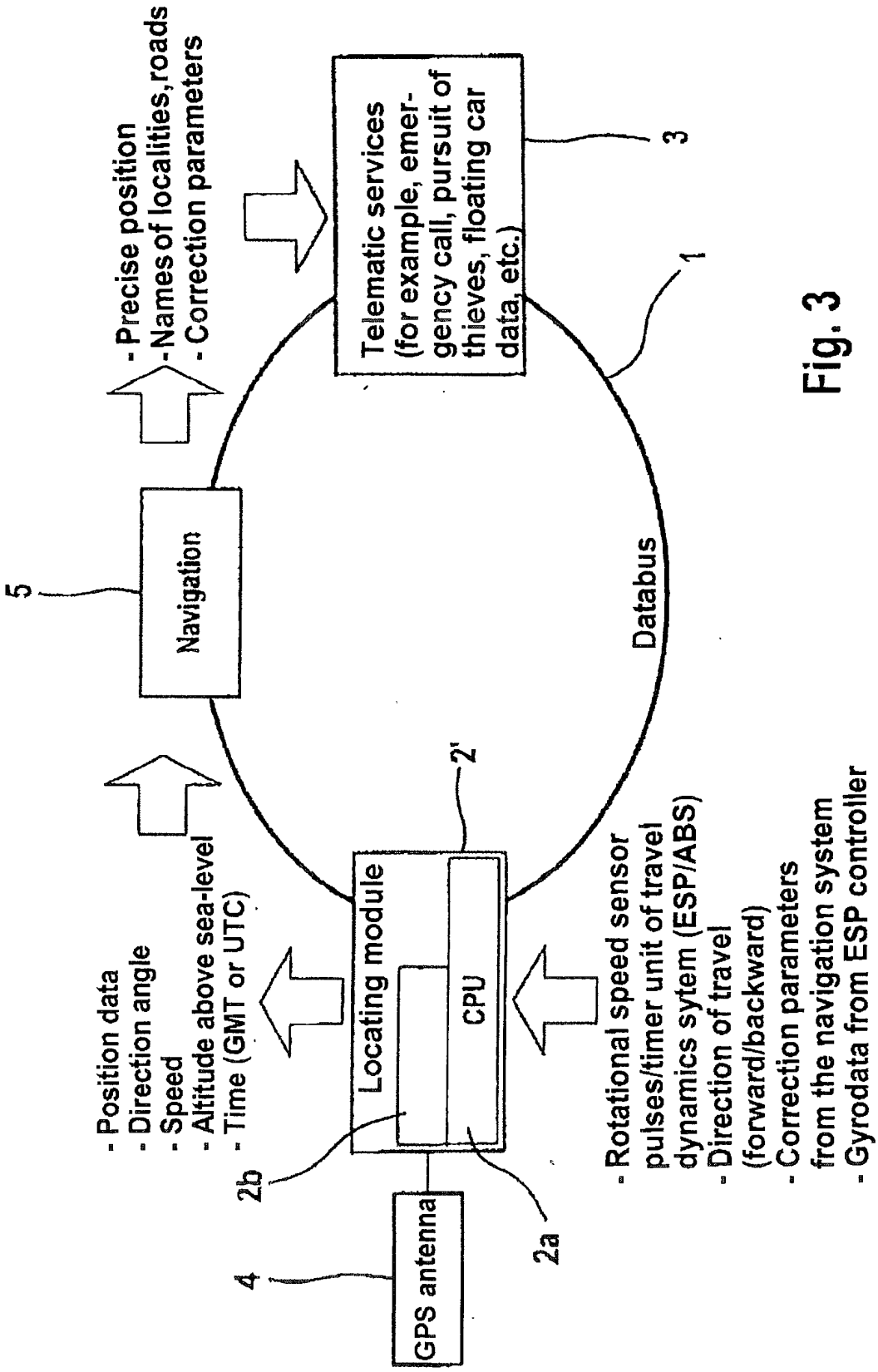
- Precise position
- Names of localities, roads
- Correction parameters
Telematic services (for example, emergency call, pursuit of thieves, floating car data, etc.)
3
1
Databus
5
Navigation
- Position data
- Direction angle
- Speed
- Altitude above sea-level
- Time (GMT or UTC)
2'
Locating module
CPU
2b
2a
4
GPS antenna
- Rotational speed sensor pulses/timer unit of travel dynamics sytem (ESP/ABS)
- Direction of travel (forward/backward)
- Correction parameters from the navigation system
- Gyrodata from ESP controller

Fig. 3

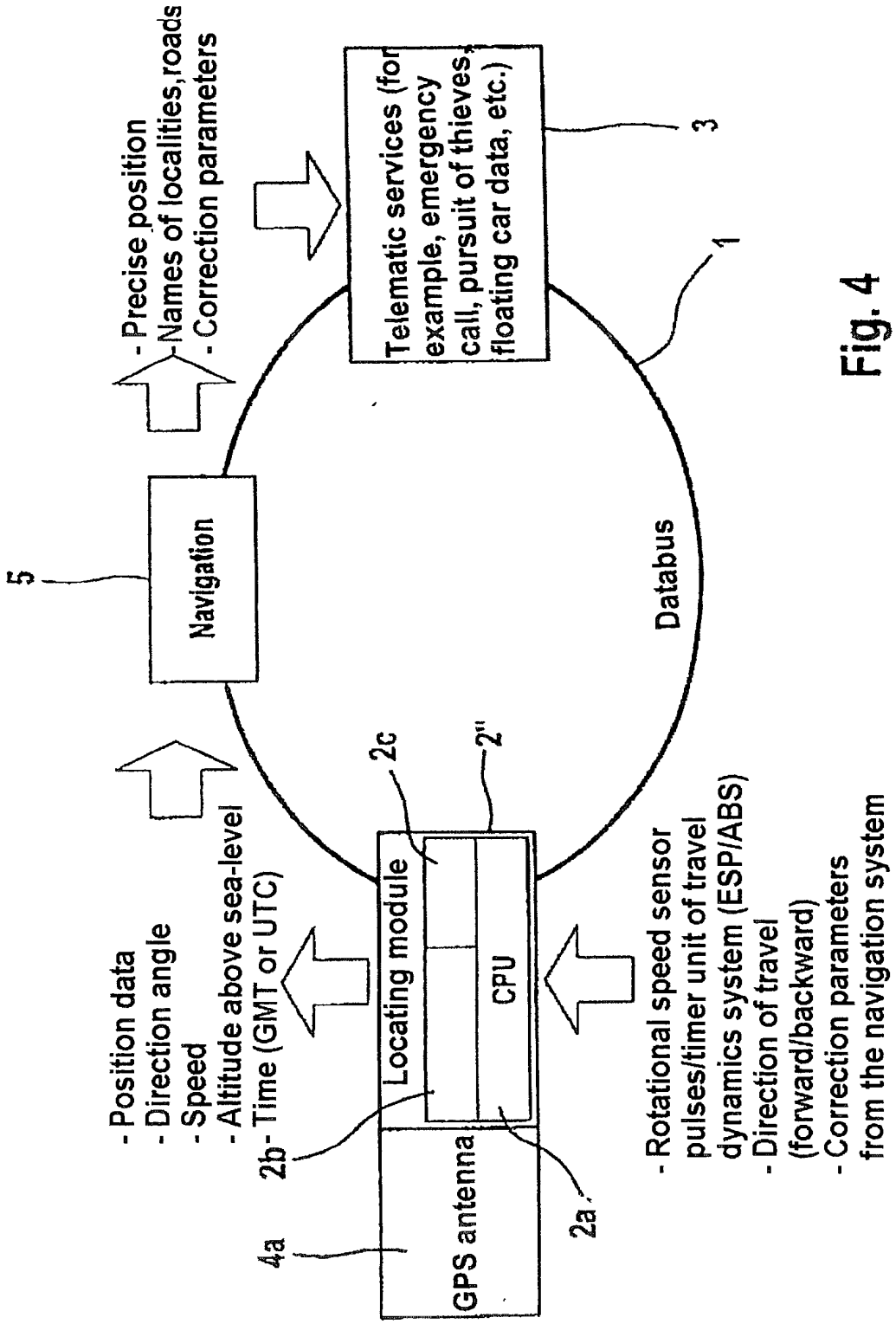
- Precise position
Names of localities,roads
- Correction parameters
Telematic services (for example, emergency call, pursuit of thieves, floating car data, etc.)
3
1
5
Navigation
Databus
- Position data
- Direction angle
- Speed
- Altitude above sea-level
- Time (GMT or UTC)
2c
2''
Locating module
CPU
2b
4a
GPS antenna
2a
- Rotational speed sensor pulses/timer unit of travel dynamics system (ESP/ABS)
- Direction of travel (forward/backward)
- Correction parameters from the navigation system

Fig. 4

VEHICLE DATA BUS SYSTEM HAVING LOCATING MEANS

BACKGROUND AND SUMMARY OF THE INVENTION

This application claims the priority of PCT International Application No. PCT/EP00/08735, filed 07 September 2000 and German patent document 199 44 177.4, 15 September 1999, the disclosure of which is expressly incorporated by reference herein.

The invention relates to a vehicle data bus system having [locating means which have] a location determining arrangement that includes a locating computing unit and a locating sensor system [which contains] having at least one GPS (Global Positioning System) receiver with associated GPS antenna and gyro data acquisition means, [as well as having a data bus via which] the data bus system also having a plurality of [connected] bus users connected to a data bus, for [have a] data transmission [connection] to one another.

European patent document EP 789 343 A1 [describes] discloses a vehicle data bus system of the generic type, having locating means and a plurality of connected bus users. GPS receivers, gyro data [determining means] sensors, wheel speed sensors, [determining means,] tachometers, odometers and acceleration

sensors can be used as locating sensor systems. A locating computing unit uses the data of the locating sensor system to determine the position data which can be output onto the data bus.

[In motor] Motor vehicles of advanced design [the applicant, for example of the S class, use is] frequently include position determining devices that [made of locating means which] operate on the basis of the GPS, and [these are,] when necessary, the latter are supported by further position-determining [means] devices for compound navigation [, which can comprise, in particular] (for example, a gyroscope and an odometer). In addition, a plurality of vehicle-mounted components, [referred to below as bus users, which are] (conventionally [first and foremost] control devices referred to herein as "bus users", for performing local vehicle- mounted control functions), are frequently connected to one another via a data bus which can be part of an entire data bus network.

Recently, telematics service units are also becoming significant [as such vehicle data] bus users. Such [, said] telematics service [users having] units have a communications connection, on the one hand, to the "vehicle world" via the vehicle data bus and, on the other hand, to remote stations, which are external to the vehicle, via one or more wireless

transmission channels. They may be used [in order,] for example, to perform functions such as emergency calls, pursuit of thieves, [the] determination of traffic situation data of sample vehicles etc.

In earlier motor vehicles of this type, the locating devices [means] on the one hand and the data bus with connected vehicle control devices on the other hand formed separate vehicle subsystems, and [which are separate from one another, and of which] frequently [also] only one of the two was implemented. The locating [means] devices themselves [frequently] were frequently composed of a relatively large number of individual components. [The patent US 5.644.317 discloses] U.S. Patent No. 5,644,317 for example, discloses an automatic vehicle locating system having [in which] a locating sensor system composed of a plurality of individual sensor units, and a locating computing unit [to] which receives [the] output signals of the various locating sensor units. [are fed are provided in the vehicle.] The locating computing unit outputs [the] data relating to the vehicle position and vehicle situation [which are acquired by it] to an external unit via a wireless communications channel for presentation of the transmitted position/situation data.

A vehicle-position-determining system disclosed in [patent US 5.740.049] U.S. Patent No. 5,740,049 determines[,] a first

temporary position information item by reference to the output signals of a vehicle speed sensor and a gyroscope, [a first temporary position information item,] and corrects it by deriving a second temporary position information item by reconciliation with stored route data. A [and acquires a] third temporary position information item is acquired from the output signal of a GPS receiver. By evaluating or reconciling the various temporary position information items, a definitive vehicle position is determined and displayed on a screen in a road map view.

The locating [means] devices are often an integrated component connected upstream of a vehicle navigation unit, [or are connected upstream of it with] for the sole purpose of supplying [the] position and situation data (i.e., orientation of the vehicle in space) data [which is necessary] for [the] navigation [and which relates to the position and situation, i.e. orientation, of the vehicle in space] and/or [of] for visually displaying [the] determined position or situation of the vehicle. See, [, see,] for example, European patent document [the laid-open publications] EP 0 675 341 A1 and International patent document WO 98/36288 A1.

International patent document [The laid-open application] WO 98/10246 A1 discloses a device for recording geographic data

which, depending on the configuration, can be determined as a portable device or for installation[,] in a vehicle, for example, and has not only position-determining means but also video cameras for recording images. A computer unit receives the data [which is] output by the positioning-determining means and the video cameras and evaluates it to [the effect that] determine the direction of the image relative to the device, or the geographic data for an object sensed with the camera. [can be determined.] The device can have a communications connection via a wireless communications channel to a remote station, for example a central processor unit there.

German patent document [In the laid-open publication] DE 196 40 735 A1[,] discloses a telematics device [is described] for a motor vehicle, which [comprises] includes a car radio with an RDS module and a built-in locating system with GPS module, a radio telephone with GSM module, a memory and a display. The RDS module, the GPS module and the GSM module are installed together with a voice unit and the car radio in a housing of the telematics device[, the]. The housing has [having at least] antenna terminals for at least the car radio, the GSM module and the GPS module as well as interfaces for at least one CAN bus and/or one further data bus as well as for at least one loudspeaker and/or a microphone. By means of travel sensors[,] (for example wheel sensors, a direction sensor and/or the GPS

module), the position of the vehicle can also be connected and output on a digital map of the visual display. By communicating with a control [centre] center or a navigation system which is built into the telematics device or a navigation module which can be connected thereto via the CAN bus or the further data bus, it is possible to calculate a desired travel route which is then displayed on the visual display. Via the CAN bus and/or the further data bus, the telematics device can influence an engine control unit which forms a further bus user.

One object of the [The] invention is to provide [based on the technical problem of making available] a vehicle data bus system of the type described above [mentioned at the beginning], which is flexible and [has a] convenient to use, [locating functionality which can be used in a comparatively flexible way] and can be satisfactorily standardized.

This and other objects and advantages are achieved by the vehicle data bus system according to the invention, in which [The invention solves this problem by making available a vehicle data bus system having the features of Claim 1. In said claim, the locating means characteristically contain] a locating module [which] is embodied in a specific way as one of the bus users connected to the data bus. [, in which locating module the components] Components of the locating module which are used for

locating the vehicle are [contained largely] integrated primarily into a single [in one] structural unit. The [, the] associated locating sensor system [being] is at least partially integrated into the locating module and also connected to the data bus so that the locating module acquires at least part of the necessary locating sensor data [at least partially in an internal fashion] internally, and also receives it via the data bus. Specifically, the locating module contains a locating computing unit, which performs the computational determination of a position, and a GPS receiver. [Furthermore,] In addition, it has a gyroscope or means for receiving corresponding gyro data via the data bus from a travel dynamics/traction control system if the latter comprises the respective gyro data acquisition sensor system[,] (as, [is the case,] for example, in some conventional travel dynamics control systems).

As a result of the modular combination and the data bus connection of the locating [means,] apparatus, they can be [used in a] standardized form for use in different vehicles (and in different countries) without extensive adaptation measures, and [make available] can provide appropriate locating information on the data bus in a flexible way according to need, from which data bus said information can be called by other vehicle-mounted bus users. The locating information which is thus made available comprises [here], in particular, vehicle position data, direction

of travel angle data, travel speed data and altitude [position] data[, i.e.] (data on the instantaneous altitude position of the vehicle above sea level) (NN). In a preferred embodiment of the invention, a [A] locating precision classification (location quality) is also provided in the form of an identifier which indicates the degree of unreliability of the calculated position data. [is preferably specified for the position data.]

In order to determine [this] the locating information, the locating module uses not only the gyro data and the GPS data, but also wheel speed data and data indicating whether the vehicle is driving forward or backward at a given time, [i.e. forward/ backward direction of travel data,] which it obtains from the data bus. The locating information can be used, in particular for vehicle control units [which make use of such information and] which [have] perform various vehicle-related [functionalities] functions, such as travel dynamics control, anti-lock brake control, traction control, engine control and gearbox control, by display instruments such as a combination instrument or by a specific comfort information display, [but] and also by communication units which communicate with [the] vehicle-mounted components via the data bus and with remote components, external to the vehicle, via a wireless communications channel.

In [a] another embodiment of the vehicle data bus system

according to the invention, [which is developed according to Claim 4,] the structural unit which represents the locating module [additionally] also contains an integrated GPS antenna so that it is [not necessary] unnecessary to mount a separate GPS antenna on the vehicle or to connect it to the locating module.

In still another embodiment of the invention, [a vehicle data bus system developed according to Claim 5,] a navigation unit, which receives the position data from the locating module, is provided as a further bus user. By means of a conventional map-matching process in which this position data is compared with stored travel network data, it acquires improved position information with a new location position classification (location quality). The navigation unit characteristically feeds back the corresponding position correction data via the data bus to the locating module which can use said data for precision-improving correction reconciliation.

In yet another embodiment of the invention, [a vehicle data bus system developed according to Claim 8,] one or more telematics service units are provided as further bus users, which use the locating data acquired from the locating module[,] (for example for an emergency call function) to pursue [, for the pursuit of] thieves and/or [for the determination of] to determine traffic situations using sample vehicles (what is

referred to as a floating car data method).

According to another embodiment of the invention, [In a vehicle data bus system developed according to Claim 9,] an engine and/or a gearbox control unit, [is] provided as a [respective] further bus user, [. The engine and/or the gearbox control unit] utilizes the data bus connection, inter alia, to read in the altitude position data made available by the locating module. As a result, it is possible to dispense with an altitude sensor which is conventionally present in modern units of this type.

Finally, [In a vehicle data bus system developed] according to another feature of the invention, [Claim 10,] the locating module is part of a further bus user, which uses the locating computing unit [being used by this bus user] for additional tasks.

Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[Advantageous embodiments of the invention are illustrated in the drawings and will be described below. In the drawings:]

Figure 1 [shows] is a [schematic] partial schematic representation of a vehicle data bus system with locating module with integrated gyroscope and external GPS antenna[,] according to the invention;

Figure 2 shows a [view] data bus system corresponding to Figure 1, [but for a modified data bus system] with an additional navigation unit; [,]

Figure 3 shows a [view] data bus system corresponding to that of Figure 2, [but for a modified data bus system] with a locating module which does not have a gyroscope and which receives gyro data from the bus; [,] and

Figure 4 shows a [view] data bus system corresponding to Figure 2, [but for a modified data bus system] with GPS antenna integrated into the locating module.

DETAILED DESCRIPTION OF THE DRAWINGS

The vehicle data bus system which is illustrated in Figure 1 (showing only those [with its] components which are of specific

interest here) [in Figure 1] contains a data bus 1 to which a plurality of bus users are connected. Only [, of which bus users] a locating module 2 and a telematics service block 3 are shown explicitly, with one or more telematics service units for corresponding functionalities[,] (for example emergency calls, pursuit of thieves and the determination of traffic situations using sample vehicles) [,] being combined by [way of simplification in said] the telematic service block 3, for simplicity. The locating module 2 [which] is provided [implemented] as a component that [which] can be built on in a uniform fashion; it contains a locating computing unit 2a, a GPS receiver 2b and a gyroscope 2c in an integrated form in this example.

An external GPS antenna 4 which is mounted at a suitable location on the vehicle is connected to the GPS receiver 2b. The locating module 2 is coupled into the data bus 1 via a corresponding bus interface, from which it [and] reads in wheel speed data and forward/backward direction of travel data. [from said data bus.] The wheel speed data can be supplied, for example, in the form of rotational speed sensor pulses per time unit by a travel dynamics/traction control system which also acquires this data for its own use, [as is] in a known manner. [per se. Here, the] The travel dynamics/traction control system can be, for example, an anti-lock brake system (ABS) or a travel

dynamics control system which is used by the applicant under the abbreviation ESP (electronic stability program). The forward/backward direction of travel data indicates whether the vehicle is travelling forward or backward at a given time, and can originate, for example, from reverse-gear detection means, which determine whether or not the reverse gear is engaged.

[If the locating module 2 does not acquire the data] Data that are necessary for locating, which the locating module 2 does not acquire from the data bus 1, [said data is] are supplied by the integrated locating sensor units, specifically GPS data of the GPS receiver 2b and gyro data of the gyroscope 2c. The locating computing unit 2a then carries out the actual computational locating process. (The [, the] term "locating" [being] is used here in a [wide] broad sense, which includes [to the effect that it covers] both a [the] determination of the position of the vehicle and its altitude, [position] and orientation in space.) That is, [Correspondingly,] the locating computing unit 2a determines vehicle position data with its locating precision classification (location quality), direction of travel angle data, travel speed data and altitude [position] data [which indicates the] (altitude of the vehicle above sea level (NN)) at a given time. [Furthermore, the] The locating computing unit 2a also contains time-determining means which provide highly precise time information corresponding to a radio

clock, the time valid in respective countries being given throughout the world, for example according to the GMT or UTC standard, without the user having to perform complicated menu settings for this purpose. The direction of travel angle data contains not only actual angle information but also offset, drift and scaling factor information.

The locating computing unit 2a feeds [this] determined, conditioned locating data onto the data bus 1 where it is made available to the other bus users, for example to the telematics service units 3 and/or vehicle control units [which are] (not shown), [explicitly,] for example engine and/or gearbox control unit, which are connected to the data bus 1. A connected engine or gearbox control unit can accept, in particular, the altitude position information made available by the locating module 2 on the data bus 1 and in this way does not require its own altitude sensor. When the system is started, the altitude value [which was respectively present last] when the vehicle was last switched off is expediently used until current altitude position data is available again.

As is apparent from the explanations above, the locating module 2 performs a locating process using a plurality of parallel input information items, specifically the internally acquired GPS data, the internally acquired gyro data and the

wheel speed data received via the data bus 1, which is also used by the locating module 2 to perform an odometer function.

The vehicle data bus system [which is] illustrated in Figure 2 (again, [merely] with only those [its] components which are specifically of interest here corresponds essentially to that in Figure 1. (Corresponding [, corresponding] reference symbols [being] are used for functionally identical elements.) The [with the exception of the] system in Figure 2, however, contains a navigation unit 5 as a further bus user. The navigation unit 5 receives[, via the data bus 1,] the various locating data items supplied by the locating module 2 via the data bus 1, and [subjects specifically] uses the received position data [to] in a conventional map-matching process in which the vehicle position determined by the locating module 2 is reconciled with data [of] in a digitally stored travel network map. In this manner, [By means of this process,] the navigation unit 5 determines a precise vehicle position, corrected if appropriate, with a new locating precision classification (locating quality) and outputs this and accompanying travel network information[,] (such as names of localities and roads), onto the data bus 1. The bus users connected to the data bus 1 can then use for this purpose the precise vehicle position data made available by the navigation unit 5 if they require vehicle position data. This applies in particular also to the telematics service units 3.

[Furthermore, the] The navigation unit 5 also outputs onto the data bus 1 position correction data which represents the possible deviation of the precise vehicle position determined by it from the vehicle position determined by the locating module 2. The locating module 2 can obtain this fed-back position correction data or these correction parameters from the data bus 1 and use them for corresponding correction of the location which it determines, in order to improve the precision of the position-determining process.

The vehicle data bus system [which is again represented in a partial schematic view] in Figure 3 corresponds to that in Figure 2, [corresponding reference symbols being again used for functionally identical elements with the exception that] with a modified locating module 2' [is used which contains] containing only the locating computing unit 2a and the GPS receiver 2b, but no gyroscope. In this case, the locating module 2' contains means for the bus-end reception and evaluation of gyro data of a travel dynamics/traction control system, e.g. by an ESP controller. This leads to satisfactory results if the gyro sensor means of the travel dynamics/traction control system have an adequate level of precision or efficiency and reliability. The travel dynamics/traction control system makes available the determined gyro data on the data bus 1, from where it can be called by the locating module 2'.

The vehicle data bus system [which is] illustrated [in a schematic partial view] in Figure 4 corresponds to that in Figure 2, [identical reference symbols being again used for functionally identical elements with the exception that] with a modified locating module 2", that also [is used which additionally] contains an integrated GPS antenna 4a. As a result, the need for a GPS antenna which is to be separately mounted on the vehicle and connected to the locating module is dispensed with.

As the above exemplary embodiments make clear, the present invention implements a vehicle data bus system in which a locating module which is implemented as a stand-alone structural unit[,] (for example in the form of a separate box or plug-in module) [,] is integrated into the bus system as a bus user and contains all the components which are used for determining locations and receives input information necessary for this purpose via the data bus. The locating module can be used as a small standard box throughout the world in a wide variety of vehicles without extensive adaptation measures. Even without an implemented navigation functionality or emergency call functionality, it is possible to use the location-related services, such as pursuit of thieves, the determination of traffic situations using sample vehicles etc. by means of the locating data supplied by the locating module.

The use of the locating data [which is made available] provided by the locating module makes the system independent of the manufacturers of communications devices which are used, such as telephone sets. The locating data of the locating module can be used to display the compass direction and/or degrees of longitude and of latitude of the current vehicle position, which can be helpful for breakdown information, for example. Furthermore, a high-precision clock with the display of the current time [which is currently valid] in any [the respective] country throughout the world can be implemented without complicated menu settings by the user. The time can be displayed, for example, in a combination instrument or in an auxiliary heating module, so that [as a result of which] the need for a separate clock chip can be avoided.

The use of [the] altitude [position] information of the locating module by an engine and/or gearbox electronic system makes it possible to avoid the need for a separate altitude sensor. The locating information which is made available by the locating module in a standardized form and which relates to the position, locating precision classification (locating quality), direction of travel angle, direction of rotation, altitude position, inclination of the vehicle, etc. can be used by means of the data bus in a flexible way by the various systems which are based on locating information, for, for example, emergency

calls, calling taxis, navigation, devices which warn of imminent bends, the determination of traffic situations using sample vehicles, travel dynamics control systems, anti-lock brake systems, traction controllers, gearboxes, engine electronic systems, combination instruments and supplementary information.

The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to include everything within the scope of the appended claims and equivalents thereof.

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Vehicle data bus system having locating means

The invention relates to a vehicle data bus system having locating means which have a locating computing unit and a locating sensor system which contains at least one GPS (Global Positioning System) receiver with associated GPS antenna and gyro data acquisition means, as well as having a data bus via which a plurality of connected bus users have a data transmission connection to one another.

In motor vehicles, use is frequently made of locating means which operate on the basis of the GPS and these are, when necessary, supported by further position-determining means for compound navigation, which can comprise, in particular a gyroscope and an odometer. In addition, a plurality of vehicle-mounted components, referred to below as bus users, which are conventionally first and foremost control devices for performing local vehicle-mounted control functions, are frequently connected to one another via a data bus which can be part of an entire data bus network. Recently, telematics service units are also becoming significant as such vehicle data bus users, said telematics service users having a communications connection, on the one hand, to the "vehicle world" via the vehicle data bus and, on the other hand, to remote stations, which are external to the vehicle, via one or more wireless transmission channels in order, for example, to perform functions such as emergency calls, pursuit of thieves, determination of traffic situation data using sample vehicles etc.

In earlier motor vehicles of this type, the locating

means on the one hand and the data bus with connected vehicle control devices on the other hand formed vehicle subsystems which are separate from one another, and of which frequently also only one of the two was implemented. The locating means themselves frequently were composed of a relatively large number of individual components. The patent US 5.644.317 discloses, for example, an automatic vehicle locating system in which a locating sensor system composed of a plurality of individual sensor units and a locating computing unit to which the output signals of the various locating sensor units are fed are provided in the vehicle. The locating computing unit outputs the data relating to the vehicle position and vehicle situation which are acquired by it to an external unit via a wireless communications channel for presentation of the transmitted position/situation data.

A vehicle-position-determining system disclosed in patent US 5.740.049 determines, by reference to the output signals of a vehicle speed sensor and a gyroscope, a first temporary position information item, corrects it by deriving a second temporary position information item by reconciliation with stored route data and acquires a third temporary position information item from the output signal of a GPS receiver. By evaluating or reconciling the various temporary position information items, a definitive vehicle position is determined and displayed on a screen in a road map view.

The locating means are often an integrated component of a vehicle navigation unit or are connected upstream of it with the sole purpose of supplying the data which is necessary for the navigation and which relates to the position and situation, i.e. orientation, of the vehicle in space and/or of visually displaying the

determined position or situation of the vehicle, see, for example, the laid-open publications EP 0 675 341 A1 and WO 98/36288 A1.

The laid-open application WO 98/10246 A1 discloses a device for recording geographic data which, depending on the configuration, can be determined as a portable device or for installation, in a vehicle, for example, and has not only position-determining means but also video cameras for recording images. A computer unit receives the data which is output by the positioning-determining means and the video cameras and evaluates it to the effect that the direction of the image relative to the device, or the geographic data for an object sensed with the camera can be determined. The device can have a communications connection via a wireless communications channel to a remote station, for example a central processor unit there.

In the laid-open publication DE 196 40 735 A1, a telematics device is described for a motor vehicle which comprises a car radio with an RDS module and a built-in locating system with GPS module, a radio telephone with GSM module, a memory and a display. The RDS module, the GPS module and the GSM module are installed together with a voice unit and the car radio in a housing of the telematics device, the housing having at least antenna terminals for the car radio, the GSM module and the GPS module as well as interfaces for at least one CAN bus and/or one further data bus as well as for at least one loudspeaker and/or a microphone. By means of travel sensors, for example wheel sensors, a direction sensor and/or the GPS module, the position of the vehicle can also be connected and output on a digital map of the visual display. By communicating with a control centre or a navigation system which is built into the telematics

device or a navigation module which can be connected thereto via the CAN bus or the further data bus, it is possible to calculate a desired travel route which is then displayed on the visual display. Via the CAN bus and/or the further data bus, the telematics device can influence an engine control unit which forms a further bus user.

The invention is based on the technical problem of making available a vehicle data bus system of the type mentioned at the beginning which has a convenient locating functionality which can be used in a comparatively flexible way and satisfactorily standardized.

The invention solves this problem by making available a vehicle data bus system having the features of Claim 1. In said claim, the locating means characteristically contain a locating module which is embodied in a specific way as one of the bus users connected to the data bus, in which locating module the components which are used for locating the vehicle are contained largely integrated in one structural unit, the associated locating sensor system being at least partially integrated into the locating module and also connected to the data bus so that the locating module acquires the necessary locating sensor data at least partially in an internal fashion and also receives it via the data bus. Specifically, the locating module contains a locating computing unit which performs the computational determination of a position, and a GPS receiver. Furthermore, it has a gyroscope or means for receiving corresponding gyro data via the data bus from a travel dynamics/traction control system if the latter comprises the respective gyro data acquisition sensor system, as is the case, for example, in some conventional travel dynamics control systems.

As a result of the modular combination and the data bus connection of the locating means, they can be used in a standardized form for different vehicles and in different countries without extensive adaptation measures and make available appropriate locating information on the data bus in a flexible way according to need, from which data bus said information can be called by other vehicle-mounted bus users. The locating information which is made available comprises here, in particular, vehicle position data, direction of travel angle data, travel speed data and altitude position data, i.e. data on the instantaneous altitude position of the vehicle above sea level (NN). A locating precision classification (location quality) in the form of an identifier which indicates the unreliability of the calculated position data is preferably specified for the position data. In order to determine this locating information, the locating module uses not only the gyro data and the GPS data but also wheel speed data and data indicating whether the vehicle is driving forward or backward at a given time, i.e. forward/backward direction of travel data, which it obtains from the data bus. The locating information can be used, in particular for vehicle control units which make use of such information and which have various vehicle-related functionalities such as travel dynamics control, anti-lock brake control, traction control, engine control and gearbox control, by display instruments such as a combination instrument or by a special supplementary information display, but also by communication units which communicate with the vehicle-mounted components via the data bus and with remote components, external to the vehicle, via a wireless communications channel.

In a vehicle data bus system which is developed according to Claim 2, the structural unit which

represents the locating module additionally contains an integrated GPS antenna so that it is not necessary to mount a separate GPS antenna on the vehicle or connect it to the locating module.

In a vehicle data bus system developed according to Claim 3, a navigation unit, which receives the position data from the locating module, is provided as a further bus user. By means of a conventional map-matching process in which this position data is compared with stored travel network data, it acquires improved position information with a new location position classification (location quality). The navigation unit characteristically feeds back the corresponding position correction data via the data bus to the locating module which can use said data for precision-improving correction reconciliation.

In a vehicle data bus system developed according to Claim 4, one or more telematics service units are provided as further bus users, which use the locating data acquired from the locating module, for example for an emergency call function, for the pursuit of thieves and/or for the determination of traffic situations using sample vehicles (what is referred to as a floating car data method).

In a vehicle data bus system developed according to Claim 5, an engine and/or a gearbox control unit is provided as a respective further bus user. The engine and/or the gearbox control unit utilizes the data bus connection, inter alia, to read in the altitude position data made available by the locating module. As a result, it is possible to dispense with an altitude sensor which is conventionally present in modern units of this type.

In a vehicle data bus system developed according to Claim 6, the locating module is part of a further bus user, the locating computing unit being used by this bus user for additional tasks.

Advantageous embodiments of the invention are illustrated in the drawings and will be described below. In the drawings:

Figure 1 shows a schematic partial representation of a vehicle data bus system with locating module with integrated gyroscope and external GPS antenna,

Figure 2 shows a view corresponding to Figure 1 but for a modified data bus system with additional navigation unit,

Figure 3 shows a view corresponding to Figure 2 but for a modified data bus system with a locating module which does not have a gyroscope and which receives gyro data from the bus, and

Figure 4 shows a view corresponding to Figure 2 but for a modified data bus system with GPS antenna integrated into the locating module.

The vehicle data bus system which is illustrated only with its components which are of specific interest here in Figure 1 contains a data bus 1 to which a plurality of bus users are connected, of which bus users a locating module 2 and a telematics service block 3 are shown explicitly, one or more telematics service units for corresponding functionalities, for example emergency calls, pursuit of thieves and the determination of traffic situations using sample

vehicles, being combined by way of simplification in said telematic service block 3. The locating module 2 which is implemented as a component which can be built on in a uniform fashion contains a locating computing unit 2a, a GPS receiver 2b and a gyroscope 2c in an integrated form in this example.

An external GPS antenna 4 which is mounted at a suitable location on the vehicle is connected to the GPS receiver 2b. The locating module 2 is coupled into the data bus 1 via a corresponding bus interface and reads in wheel speed data and forward/backward direction of travel data from said data bus. The wheel speed data can be supplied, for example, in the form of rotational speed sensor pulses per time unit by a travel dynamics/traction control system which also acquires this data for its own use, as is known per se. Here, the travel dynamics/traction control system can be, for example, an anti-lock brake system (ABS) or a travel dynamics control system which is used by the applicant under the abbreviation ESP (electronic stability program). The forward/backward direction of travel data indicates whether the vehicle is travelling forward or backward at a given time, and can originate, for example, from reverse-gear detection means, which determine whether or not the reverse gear is engaged.

If the locating module 2 does not acquire the data necessary for locating from the data bus 1, said data is supplied by the integrated locating sensor units, specifically GPS data of the GPS receiver 2b and gyro data of the gyroscope 2c. The locating computing unit 2a then carries out the actual computational locating process, the term "locating" being used here in a wide sense to the effect that it covers both the determination of the position of the vehicle and its altitude position and orientation in space.

Correspondingly, the locating computing unit 2a determines vehicle position data with its locating precision classification (location quality), direction of travel angle data, travel speed data and altitude position data which indicates the altitude of the vehicle above sea level (NN) at a given time. Furthermore, the locating computing unit 2a contains time-determining means which provide highly precise time information corresponding to a radio clock, the time valid in respective countries being given throughout the world, for example according to the GMT or UTC standard, without the user having to perform complicated menu settings for this purpose. The direction of travel angle data contains not only actual angle information but also offset, drift and scaling factor information.

The locating computing unit 2a feeds this determined, conditioned locating data onto the data bus 1 where it is made available to the other bus users, for example to the telematics service units 3 and/or vehicle control units which are not shown explicitly, for example engine and/or gearbox control unit, which are connected to the data bus 1. A connected engine or gearbox control unit can accept, in particular, the altitude position information made available by the locating module 2 on the data bus 1 and in this way does not require its own altitude sensor. When the system is started, the altitude value which was respectively present last when the vehicle was switched off is expediently used until current altitude position data is available again.

As is apparent from the explanations above, the locating module 2 performs a locating process using a plurality of parallel input information items, specifically the internally acquired GPS data, the

internally acquired gyro data and the wheel speed data received via the data bus 1, which is also used by the locating module 2 to perform an odometer function.

The vehicle data bus system which is illustrated in Figure 2 again merely with its components which are specifically of interest here corresponds essentially to that in Figure 1, corresponding reference symbols being used for functionally identical elements with the exception of the system in Figure 2 contains a navigation unit 5 as a further bus user. The navigation unit 5 receives, via the data bus 1, the various locating data items supplied by the locating module 2 and subjects specifically the received position data to a conventional map-matching process in which the vehicle position determined by the locating module 2 is reconciled with data of a digitally stored travel network map. By means of this process, the navigation unit 5 determines a precise vehicle position, corrected if appropriate, with a new locating precision classification (locating quality) and outputs this and accompanying travel network information, such as names of localities and roads, onto the data bus 1. The bus users connected to the data bus 1 can then use for this purpose the precise vehicle position data made available by the navigation unit 5 if they require vehicle position data. This applies in particular also to the telematics service units 3.

Furthermore, the navigation unit 5 outputs onto the data bus 1 position correction data which represents the possible deviation of the precise vehicle position determined by it from the vehicle position determined by the locating module 2. The locating module 2 can obtain this fed-back position correction data or these correction parameters from the data bus 1 and use them for corresponding correction of the location which it

determines, in order to improve the precision of the position-determining process.

The vehicle data bus system which is again represented in a partial schematic view in Figure 3 corresponds to that in Figure 2, corresponding reference symbols being again used for functionally identical elements with the exception that a modified locating module 2' is used which contains only the locating computing unit 2a and the GPS receiver 2b, but no gyroscope. In this case, the locating module 2' contains means for the bus-end reception and evaluation of gyro data of a travel dynamics/traction control system, e.g. by an ESP controller. This leads to satisfactory results if the gyro sensor means of the travel dynamics/traction control system have an adequate level of precision or efficiency and reliability. The travel dynamics/traction control system makes available the determined gyro data on the data bus 1, from where it can be called by the locating module 2'.

The vehicle data bus system which is illustrated in a schematic partial view in Figure 4 corresponds to that in Figure 2, identical reference symbols being again used for functionally identical elements with the exception that a modified locating module 2" is used which additionally contains an integrated GPS antenna 4a. As a result, the need for a GPS antenna which is to be separately mounted on the vehicle and connected to the locating module is dispensed with.

As the above exemplary embodiments make clear, the present invention implements a vehicle data bus system in which a locating module which is implemented as a stand-alone structural unit, for example in the form of a separate box or plug-in module, is integrated into the bus system as a bus user and contains all the

components which are used for determining locations and receives input information necessary for this purpose via the data bus. The locating module can be used as a small standard box throughout the world in a wide variety of vehicles without extensive adaptation measures. Even without an implemented navigation functionality or emergency call functionality, it is possible to use the location-related services, such as pursuit of thieves, the determination of traffic situations using sample vehicles etc. by means of the locating data supplied by the locating module. The use of the locating data which is made available by the locating module makes the system independent of the manufacturers of communications devices which are used, such as telephone sets. The locating data of the locating module can be used to display the compass direction and/or degrees of longitude and of latitude of the current vehicle position, which can be helpful for breakdown information, for example. Furthermore, a high-precision clock with the display of the time which is currently valid in the respective country throughout the world can be implemented without complicated menu settings by the user. The time can be displayed, for example, in a combination instrument or in an auxiliary heating module, as a result of which the need for a separate clock chip can be avoided. The use of the altitude position information of the locating module by an engine and/or gearbox electronic system makes it possible to avoid the need for a separate altitude sensor. The locating information which is made available by the locating module in a standardized form and which relates to the position, locating precision classification (locating quality), direction of travel angle, direction of rotation, altitude position, inclination of the vehicle, etc. can be used by means of the data bus in a flexible way by the various systems which are based on locating information, for,

for example, emergency calls, calling taxis, navigation, devices which warn of imminent bends, the determination of traffic situations using sample vehicles, travel dynamics control systems, anti-lock brake systems, traction controllers, gearboxes, engine electronic systems, combination instruments and supplementary information.

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Patent claims

1. Vehicle data bus system having the following features:

- a data bus (1) via which a plurality of connected bus users have a data transmission connection to one another, and
- locating means with a locating module (2) which is embodied as one of the bus users and which is configured to receive at least wheel speed data and forward/backward direction of travel data via the data bus (1) to acquire at least vehicle position data, direction of travel angle data, travel speed data and altitude position data and to output this acquired data onto the data bus, and for this purpose has a locating computing unit (2a) and a locating sensor system which comprises at least a GPS receiver (2b) with associated GPS antenna (4) and gyro data-sensing means (2c) in the form of the gyroscope (2c) or means for the bus-end reception and evaluation of gyro data of a travel dynamics/traction control system.

2. Vehicle data bus system according to Claim 1, further characterized in that the locating module (2") contains an integrated GPS antenna (4a).

3. Vehicle data bus system according to Claim 1 or 2, further characterized in that a further bus user is formed by a navigation unit (5), which receives the vehicle position data from the locating module (2) via the data bus (1), and by means of a map-matching process acquires position correction data which it inputs into the data bus in order to feed it back to

the locating module.

4. Vehicle data bus system according to one of Claims 1 to 3, further characterized in that one or more telematics service units (3) are provided as further bus users which use data acquired from the locating module (2) or the navigation unit (5).

5. Vehicle data bus system according to one of Claims 1 to 4, further characterized in that an engine and/or gearbox control unit, which makes use of the altitude position data acquired from the locating module (2), is provided as a respective further bus user.

6. Vehicle data bus system according to one of Claims 1 to 5, further characterized in that the locating module (2) is part of a further bus user, the locating computing unit (2a) being used by this bus user for additional tasks.

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Abstract

1. Vehicle data bus system having locating means.

2.1. The invention relates to a vehicle data bus system having locating means which comprise a locating computing unit and a locating sensor system which contains at least one GPS receiver with associated GPS antenna and gyro data acquisition means, and having a data bus via which a plurality of connected bus users have a data transmission connection to one another.

2.2. According to the invention, the locating means contain a locating module which is embodied as one of the bus users and is configured to receive at least wheel speed data and forward/backward direction of travel data via the data bus, to acquire at least vehicle position data, direction of travel angle data, travel speed data and altitude position data as well as to output this acquired data onto the data bus, and for this purpose contains the location computing unit, the GPS receiver and a gyroscope or means for the bus-end reception and evaluation of gyro data of a travel dynamics/traction control system.

2.3. Use, for example, in motor vehicles.

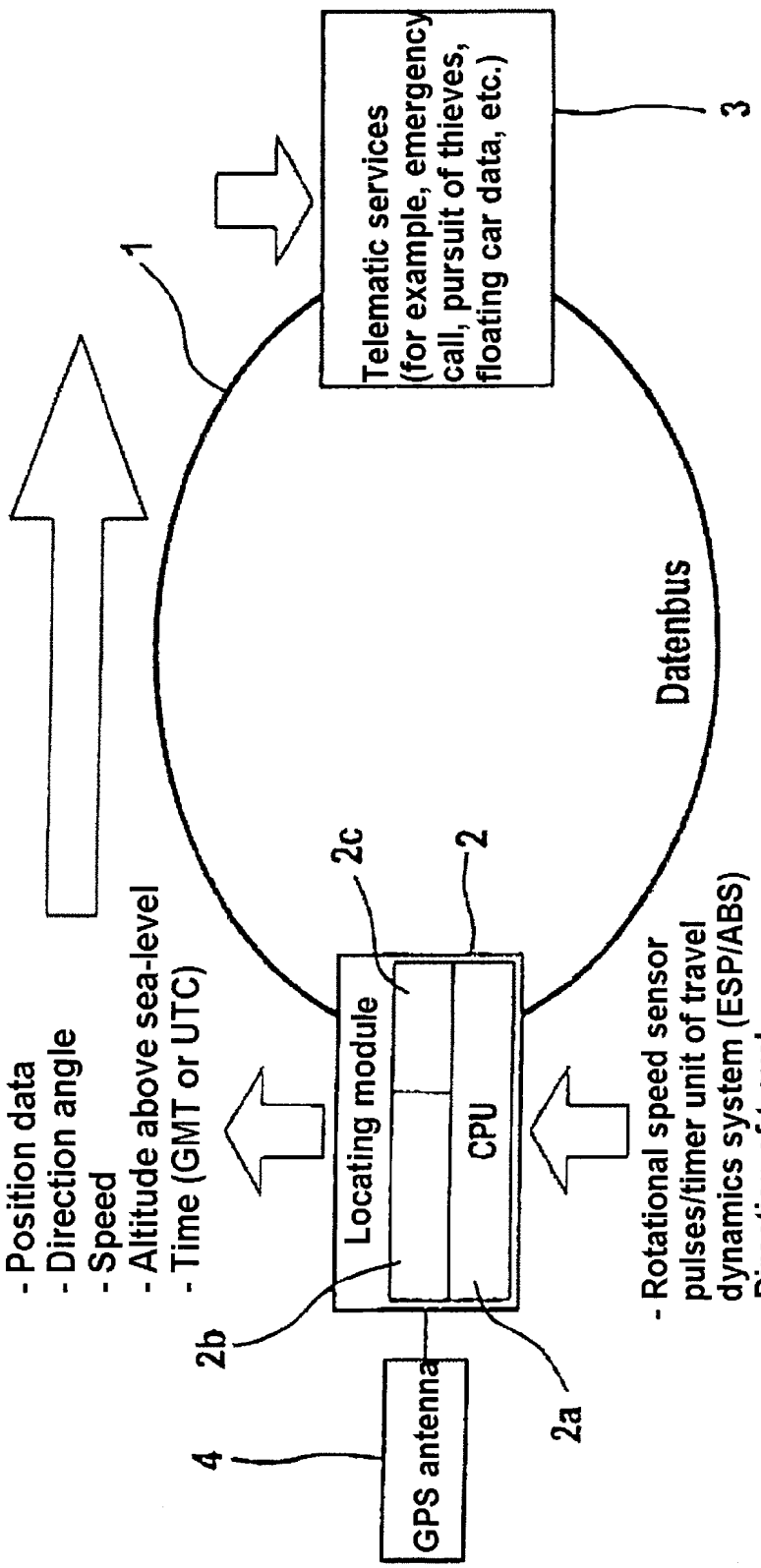
Telematic services
(for example, emergency
call, pursuit of thieves,
floating car data, etc.)
3
1
Datenbus
2c
2
Locating module
CPU
2b
2a
4
GPS antenna
- Position data
- Direction angle
- Speed
- Altitude above sea-level
- Time (GMT or UTC)
- Rotational speed sensor
pulses/timer unit of travel
dynamics system (ESP/ABS)
- Direction of travel
(forward/backward)

Fig. 1

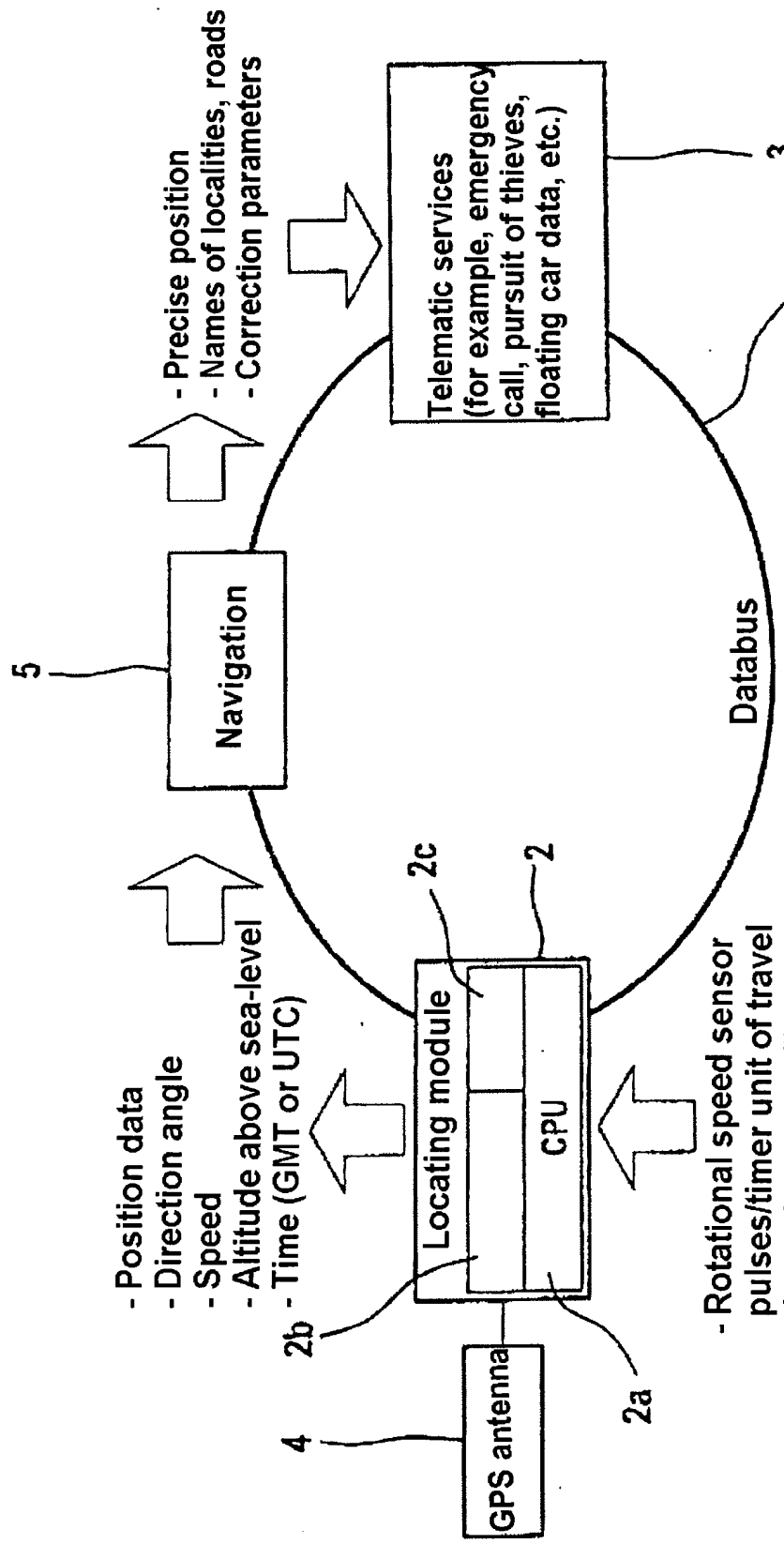
- Precise position
- Names of localities, roads
- Correction parameters
Telematic services
(for example, emergency
call, pursuit of thieves,
floating car data, etc.)
3
1
Databus
5
Navigation
- Position data
- Direction angle
- Speed
- Altitude above sea-level
- Time (GMT or UTC)
2c
2
Locating module
CPU
2b
2a
4
GPS antenna
- Rotational speed sensor
pulses/timer unit of travel
dynamics sytem (ESP/ABS)
- Direction of travel
(forward/backward)
- Correction parameters
from the navigation system

Fig. 2

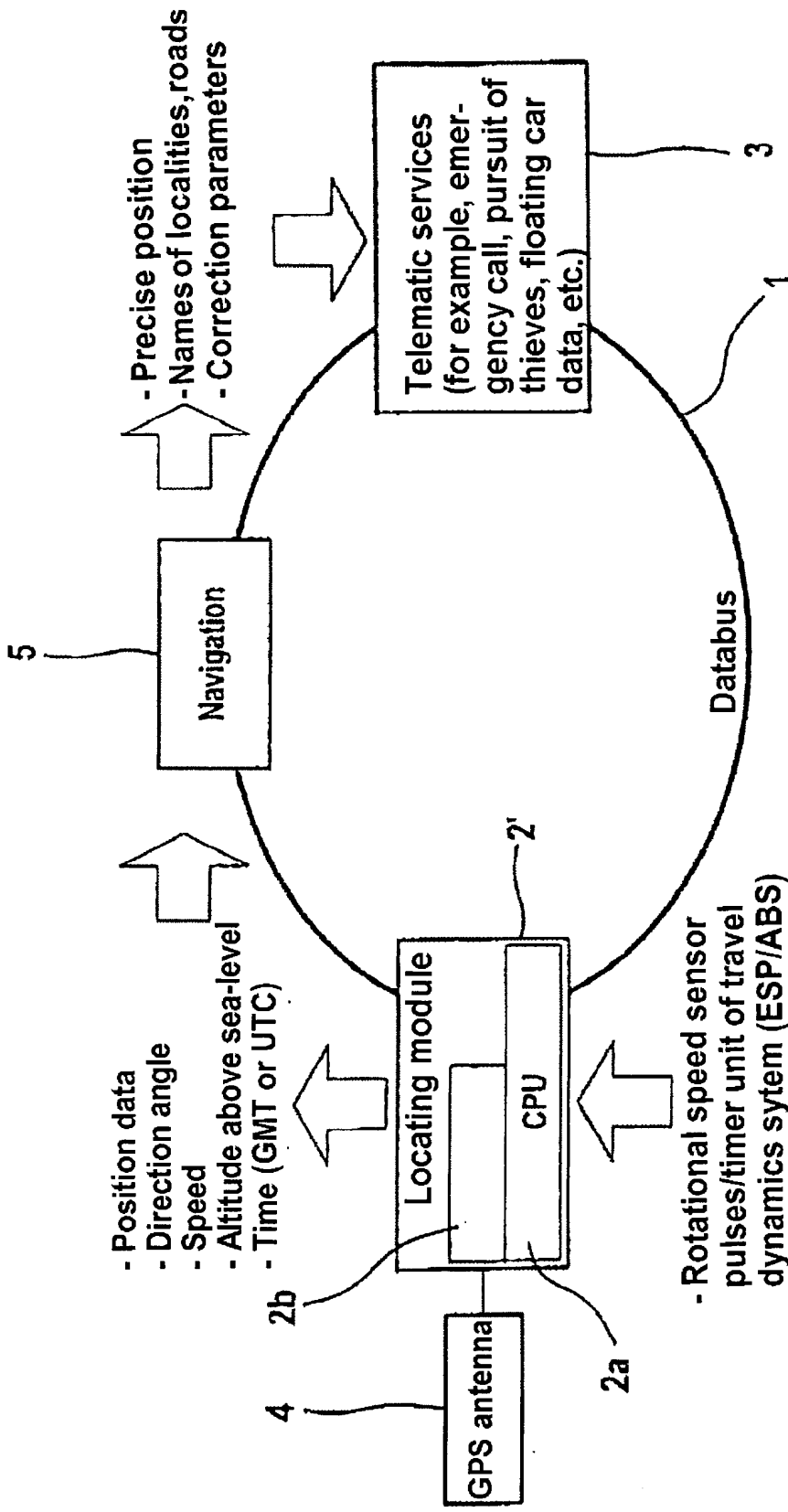
- Precise position
- Names of localities, roads
- Correction parameters
Telematic services (for example, emergency call, pursuit of thieves, floating car data, etc.)
3
1
Databus
5
Navigation
- Position data
- Direction angle
- Speed
- Altitude above sea-level
- Time (GMT or UTC)
2'
Locating module
CPU
2b
2a
4
GPS antenna
- Rotational speed sensor pulses/timer unit of travel dynamics sytem (ESP/ABS)
- Direction of travel (forward/backward)
- Correction parameters from the navigation system
- Gyrodata from ESP controller

Fig. 3

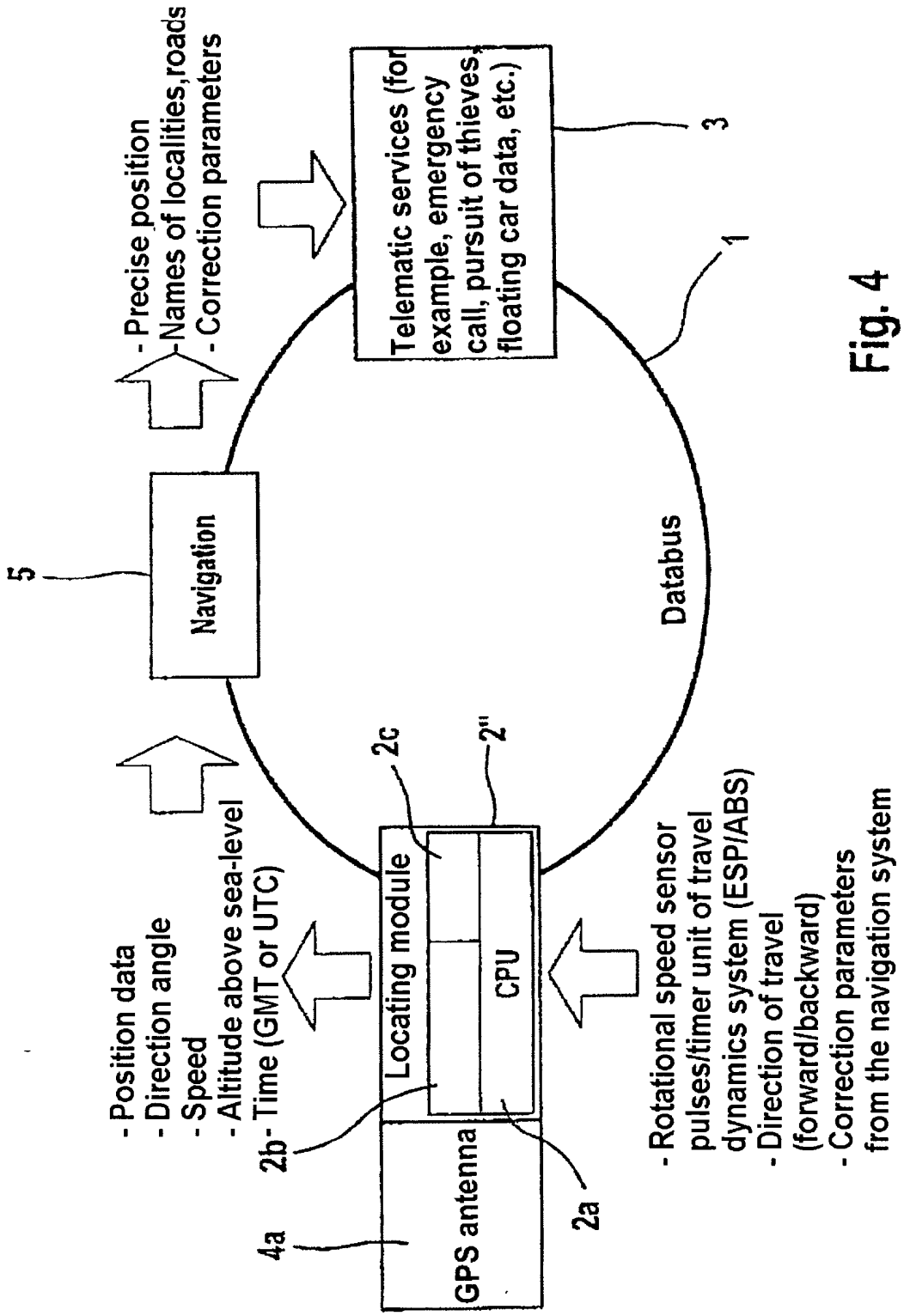
- Precise position
Names of localities,roads
- Correction parameters
Telematic services (for example, emergency call, pursuit of thieves, floating car data, etc.)
3
1
Databus
5
Navigation
- Position data
- Direction angle
- Speed
- Altitude above sea-level
- Time (GMT or UTC)
2b
Locating module
2c
2''
CPU
2a
GPS antenna
4a
- Rotational speed sensor pulses/timer unit of travel dynamics system (ESP/ABS)
- Direction of travel (forward/backward)
- Correction parameters from the navigation system

Fig. 4

Attorney Docket No. 225/50985

DECLARATION AND POWER OF ATTORNEY

(For Use with Application Data Sheet)

As the below named inventor(s), I/we declare that:

This declaration is directed to:

_ The attached application, or
X was filed as PCT international application Number PCT/EP00/08735 on 15 September 1999 (15.09.99)
_ Application No. __, filed on __,
__ as amended on __ (if applicable);

I/we believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/we have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above;

I/we acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including material information which became available between the filing date of the prior application and the National or PCT International filing date of the continuation-in-part application, if applicable;

I/we hereby appoint the practitioners at **CROWELL & MORING L.L.P.**, whose Customer Number is:

23911
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as my/our attorneys to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith; and

All statements made herein of my/our own knowledge are true; all statements made herein on information and belief are believed to be true, and further these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

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